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ENGINEERING INSTRUCTION

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

SUBJECT: Bridge Design Manual
Standard Specifications For
Highway Bridges

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APPROVED: E. V. Hourigan

The attached sheets contain editorial revisions to the 1982 Interim Specifications of the AASHTO Standard Specifications for Highway Bridges. These revisions have been issued to correct printing errors only, and are in agreement with the approved content of the AASHTO 1982 Interims. These sheets amend the New York State Standard Specifications for Highway Bridges as follows:

Page	
35	Inclusion of Col. No. 3A in Table 1.2.22 and related definitions
138	Correction to format of Table 1.7.1.A. This correction negates the need for the second paragraph on page NY 138; thus this paragraph is deleted.
150	Correction to Table for Example No. 14.

These sheets shall be incorporated into the New York State Standard Specifications for Highway Bridges effective upon receipt of this Engineering Instruction. This Engineering Instruction partially replaces Material issued under EI 82-70.

TABLE 1.2.22

Table of Coefficients γ and β

Col. No.		1	2	3	3A	4	5	6	7	8	9	10	11	12	13	14	
			β FACTORS														
GROUP		γ	D	$(L+I)_n$	$(L+I)_p$	CF	E	B	SF	W	WL	LF	R+S+T	EQ	ICE	%	
SERVICE LOAD	I	1.0	1	1	0	1	β_E	1	1	0	0	0	0	0	0	100	
	IA	1.0	1	2	0	0	0	0	0	0	0	0	0	0	0	150	
	IB	1.0	1	0	1	1	β_E	1	1	0	0	0	0	0	0	**	
	II	1.0	1	0	0	0	1	1	1	1	0	0	0	0	0	125	
	III	1.0	1	1	0	1	β_E	1	1	0.3	1	1	0	0	0	125	
	IV	1.0	1	1	0	1	β_E	1	1	0	0	0	1	0	0	125	
	V	1.0	1	0	0	0	1	1	1	1	0	0	1	0	0	140	
	VI	1.0	1	1	0	1	β_E	1	1	0.3	1	1	1	0	0	140	
	VII	1.0	1	0	0	0	1	1	1	0	0	0	0	1	0	133	
	VIII	1.0	1	1	0	1	1	1	1	0	0	0	0	0	1	140	
	IX	1.0	1	0	0	0	1	1	1	1	0	0	0	0	1	150	
	X	1.0	1	1	0	0	β_E	0	0	0	0	0	0	0	0	100	Culvert
LOAD FACTOR DESIGN	I	1.3	β_D	1.67*	0	1.0	β_E	1	1	0	0	0	0	0	0	Not Applicable	
	IA	1.3	β_D	2.20	0	0	0	0	0	0	0	0	0	0	0		
	IB	1.3	β_D	0	1	1.0	β_E	1	1	0	0	0	0	0	0		
	II	1.3	β_D	0	0	0	β_E	1	1	1	0	0	0	0	0		
	III	1.3	β_D	1	0	1	β_E	1	1	0.3	1	1	0	0	0		
	IV	1.3	β_D	1	0	1	β_E	1	1	0	0	0	1	0	0		
	V	1.25	β_D	0	0	0	β_E	1	1	1	0	0	1	0	0		
	VI	1.25	β_D	1	0	1	β_E	1	1	0.3	1	1	1	0	0		
	VII	1.3	β_D	0	0	0	β_E	1	1	0	0	0	0	1	0		
	VIII	1.3	β_D	1	0	1	β_E	1	1	0	0	0	0	0	1		
	IX	1.20	β_D	0	0	0	β_E	1	1	1	0	0	0	0	1		
	X	1.30	1	1.67	0	0	β_E	0	0	0	0	0	0	0	0		Culvert

$(L + I)_n$ = Live load plus impact for AASHTO Highway H or HS Loading

$(L + I)_p$ = Live load plus impact consistent with the overload criteria of the operating agency.

For Service Load Design

% (Column 14) Percentage of Basic Unit Stress

No increase in allowable unit stresses shall be permitted for members or connections carrying wind loads only.

β_E = 0.70 for vertical loads on Reinforced Concrete Boxes.

β_E = 1.00 for lateral loads on Reinforced Concrete Boxes.

β_E = 1.00 for vertical and lateral loads on all other culverts.

For culvert loading specifications, see Article 1.2.2.(A).

β_E = 1.0 and 0.5 for lateral loads on rigid frames (check both loadings to see which one governs). See Art. 1.2.19

*1.25 may be used for design of outside roadway beam when combination of sidewalk live load as well as traffic live load plus impact governs the design, but the capacity of the section should not be less than required for highway traffic live load only using a beta factor of 1.67. 1.00 may be used for design of deck slab with combination of loads as described in second paragraph of Article 1.3.2(B).

$$^{**}\text{Percentage} = \frac{\text{Maximum Unit Stress (Operating Rating)}}{\text{Allowable Basic Unit Stress}} \times 100$$

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For Load Factor Design

β_E = 1.0 for vertical earth pressure

β_D = 0.75 when checking member for minimum axial load and maximum moment or maximum eccentricity — for Column Design

β_D = 1.0 when checking member for maximum axial load and minimum moment — for Column Design

β_D = 1.0 for flexural and tension members

β_E = 1.0 for Rigid Culverts including Reinforced Concrete Boxes.

β_E = 1.5 for Flexible Culverts

For Group X loading (Culverts) the β_E factor shall be applied to vertical and horizontal loads.

Section 3—DISTRIBUTION OF LOADS

1.3.1—DISTRIBUTION OF WHEEL LOADS TO STRINGERS LONGITUDINAL BEAMS AND FLOOR BEAMS*

(A) Position of Loads for Shear

In calculating end shears and end reactions in transverse floor beams and longitudinal beams and stringers, no longitudinal distribution of the wheel load shall be assumed for the wheel or axle load adjacent to the end at which the stress is being determined.

Lateral distribution of the wheel load shall be that produced by assuming the flooring to act as a simple span between stringers or beams. For loads in other positions on the span, the distribution for shear shall be determined by the method prescribed for moment, except that the calculations of horizontal shear in rectangular timber beams shall be in accordance with Article 1.10.2.

(B) Bending Moment in Stringers and Longitudinal Beams**

In calculating bending moments in longitudinal beams or stringers, no longitudinal distribution of the wheel loads shall be assumed. The lateral distribution shall be determined as follows:

(1) Interior Stringers and Beams

The live load bending moment for each interior stringer shall be determined by applying to the stringer the fraction of a wheel load (both front and rear) determined in Table 1.3.1(B).

*Provisions in this Article shall not apply to orthotropic deck bridges.

**In view of the complexity of the theoretical analysis involved in the distribution of wheel loads to stringers, the empirical method herein described is authorized for the design of normal highway bridges.

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SECTION 7—STRUCTURAL STEEL DESIGN GENERAL REQUIREMENTS

1.7.1—MATERIALS AND BASIC DESIGN STRESSES

These specifications recognize steels listed in the following subparagraphs. Other steels may be used; however, their properties, strengths, allowable stresses, and workability must be established and specified.

(A) Structural Steels

Structural steels shall conform to the material designated in Table 1.7.1A The stresses in this table are in pounds per square inch (MPa).

The modulus of elasticity of all grades of structural steel shall be assumed to be 29,000,000 psi (199948 MPa) and the coefficient of linear expansion 0.0000065 per degree Fahrenheit (11 x 10^{-6} per degree C).

(B) Steels for Pins, Rollers, and Expansion Rockers

Steels for pins, rollers, and expansion rockers may conform to one of the following designations in addition to the designations listed in Table 1.7.1A.

Steel Bars, Carbon, Cold Finished, Standard Quality, AASHTO M169 (ASTM A108) Steel Forgings, Carbon and Alloy, for General Industrial Use, AASHTO M102 (ASTM A668). Design stresses for these materials are listed in the table below:

Expansion rollers shall be not less than 4 inches (101.6 mm) in diameter

AASHTO Designation with size limitations		M-169 4"(101.6mm) in dia. or less	M-102 To 20" (508mm) in dia.	M-102 To 20" (508mm) in dia.	M-102 To 10" (254mm) in dia.	M-102 To 20" (508mm) in dia.
ASTM Designation Grade or Class		A108 Grades 1016 to 1030 inc.	A-668 Class C	A-668 Class D	A-668 Class F	**A-668 Class G
Minimum Yield Point, psi (MPa)	F_y	36,000* (248.211)	33,000 (227.527)	37,500 (258.553)	50,000 (344.737)	50,000 (344.737)
Stress in Extreme Fiber, psi (MPa)	$0.80F_y$	29,000* (199.948)	26,000 (179.263)	30,000 (206.842)	40,000 (275.790)	40,000 (275.790)
Shear, psi (MPa)	$0.40F_y$	14,000* (96.526)	13,000 (89.632)	15,000 (103.421)	20,000 (137.895)	20,000 (137.895)
Bearing on pins not subject to rotation, psi*** (MPa)	$0.80F_y$	29,000* (199.948)	26,000 (179.263)	30,000 (206.842)	40,000 (275.790)	40,000 (275.790)
Bearing on pins subject to rotation, psi (MPa) (Such as used in rockers and hinges)	$0.40F_y$	14,000* (96.526)	13,000 (89.632)	15,000 (103.421)	20,000 (137.895)	20,000 (137.895)

*For design purpose only. Not a part of the A108 specifications. Supplementary material requirements should provide guarantee that material will meet these values.

**May substitute rolled material of the same properties.

***This shall apply to pins used primarily in axially loaded members, such as truss members and cable adjusting links. It shall not apply to pins used in members having rotation caused by expansion or deflection.

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TABLE 1.7.1A

ALLOWABLE DESIGN STRESSES—STRUCTURAL STEEL (All values in parenthesis are in MPa)

Type		Structural Steel	High Strength Low-Alloy Steel		High Yield Strength Quenched and Tempered Alloy Steel	
AASHTO Designation (7)		M-183	M-223	M-222	M244(A514)(8)	
Equivalent ASTM Designation		A 36	A572 Grade 50	A 588	A517 (9)(10)	
Thickness of Plates (mm)		Up to 8" (203.2) Incl (5)	Up to 2" (50.8) Incl.	Up to 4" (101.6) Incl.	Up to 2½"(63.5) Incl.	Over 2½" to 4"(63.5 to 101.6) Incl.
Shapes(8)		All Groups(5)	Shapes thru 426 lb./ft.(634 kg/m)	All Groups	Not Applicable	Not Applicable
Minimum tensile strength	F_u	58,000 (399.895)	65,000 (448.159)	70,000 (482.632)	110,000 (758.420)	100,000 (689.470)
Minimum yield point or Minimum yield strength	F_y	36,000 (248.211)	50,000 (344.737)	50,000 (344.737)	100,000 (689.470)	90,000 (620.527)
Axial tension in members with no holes for high strength bolts or rivets.	$0.55F_y$	20,000 (137.895)	27,000 (186.158)	27,000 (186.158)	Not Applicable	
Use net section when member has any open holes larger than 1¼" diam. such as perforations.	$0.46F_u$	Not Applicable			51,000 (351.632)	46,000 (317.158)
Axial tension in members with holes for high strength bolts or rivets and tension in extreme fiber of rolled shapes, girders, and built-up sections subject to bending. (Use whichever is smaller.)	Gross* Section $0.55F_y$	20,000 (137.395)	27,000 (186.158)	27,000 (186.158)	Not Applicable	
*When the area of holes deducted for high strength bolts or rivets is more than 15 percent of the gross area, that area in excess of 15 percent shall be deducted from the gross area in determining stress on the gross section. In determining gross section, any open holes larger than 1¼" diam. such as perforations shall be deducted.	Net Section $0.50F_u$	29,000 (199.948)	32,500 (224.080)	35,000 (241.318)	Not Applicable	
	Net Section $0.46F_u$	Not Applicable			51,000 (351.632)	46,000 (317.158)
Axial tension in members without holes. Axial compression, gross section: stiffeners of plate girders. Compression in splice material, gross section	$0.55F_y$	20,000 (137.895)	27,000 (186.158)	27,000 (186.158)	55,000 (379.211)	49,000 (337.843)

TABLE 1.7.2A2 (Continued)

General Condition	Situation	Kind of Stress	Stress Category (See Table 1.7.2A1)	Illustrative Example (See Fig. 1.7.2)
	(b) When provided with transition radius between 0 in. and 2 in. (0 and .051 m)	T or Rev.	E	14
Mechanically Fastened Connections	Base metal at gross section of high-strength bolted slip resistant connections, except axially loaded joints which induce out-of-plane bending in connected material	T or Rev.	B	18
	Base metal at net section of high-strength bolted bearing type connections	T or Rev.	B	18
	Base metal at net section of riveted connections	T or Rev.	D	18
Fillet Welds	Shear stress on throat of fillet welds	Shear	F	9

(B) Load Cyles

The number of cycles of maximum stress range to be considered in the design shall be selected from Table 1.7.2B unless traffic and loadometer surveys or other considerations indicate otherwise.

Allowable fatigue stresses shall apply to those Group Loadings that include live load or wind load.

The number of cycles of stress range to be considered for wind loads in combination with dead loads, except for structures where other considerations indicate a substantially different number of cycles, shall be 100,000 cycles.

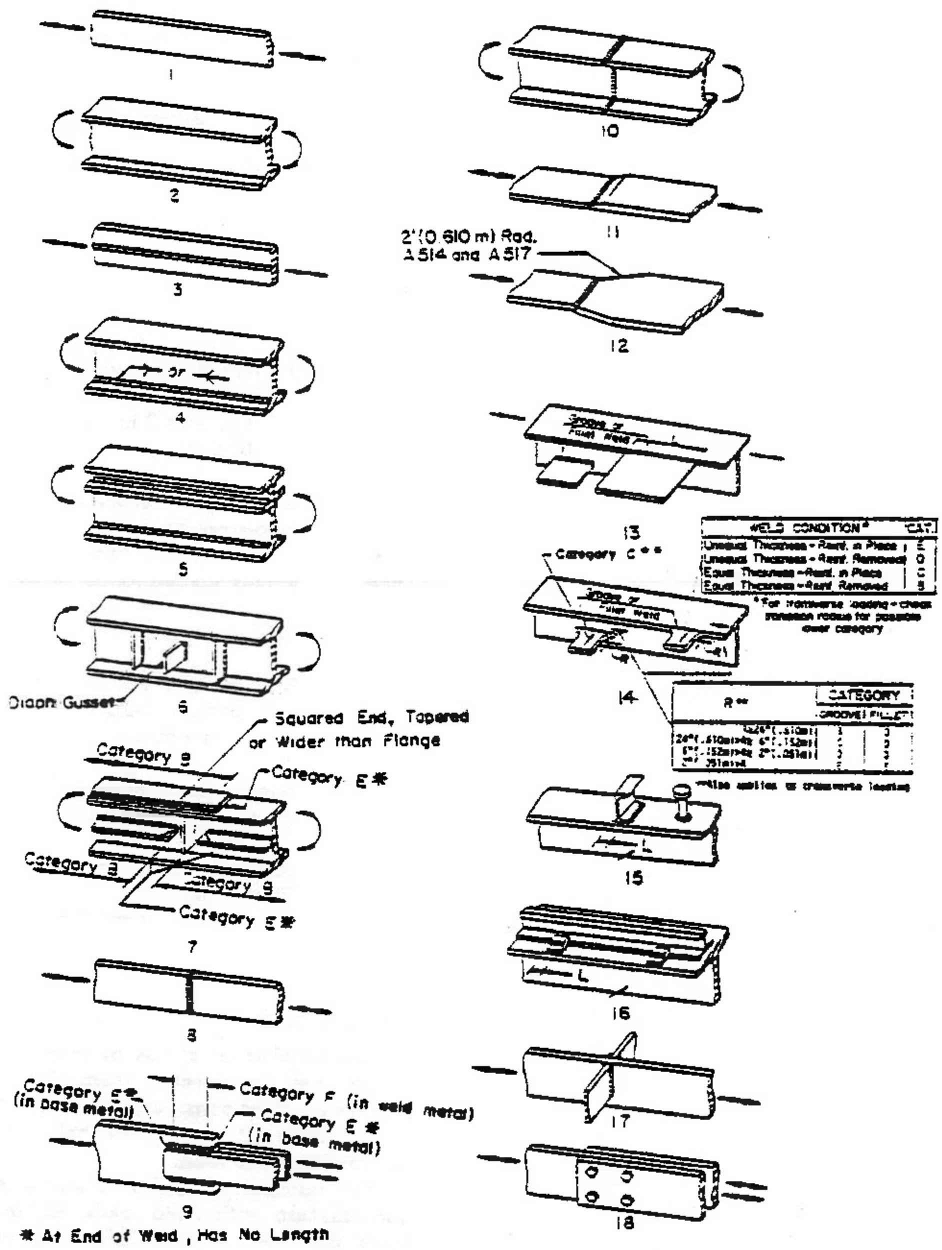

FIG. 1.7.2 — Illustrative Examples